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ABSTRACT

The "state of the craft" of instruction within the context of the mastery learning model is discussed. Little has been said in the past about specific instructional strategies that are applicable to particular instructional units or objectives, or to the daily classroom life of teachers. This paper is organized into six major sections. The first section outlines the general instructional conditions and procedures described in books and articles dealing with mastery learning. The second section discusses two aspects of the initial group-based instruction: teaching to objectives and the use of appropriate teaching methods or presentations. The third section focuses on the importance of porper sequencing of instructional activities and units. The fourth section presents information concerning corrective instruction. The fifth section briefly details the types of enrichment activities used in existing mastery learning programs. Finally, the sixth section presents ideas concerning the role of classroom management in complementing a mastery learning instructional program. Many of the instructional strategies described are those which research indicates are related to increased student involvement in learning and/or increased student achievement. (RL)

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DESIGNING INSTRUCTIONAL STRATEGIES WHICH FACILITATE LEARNING FOR MASTERY

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DESIGNING INSTRUCTIONAL STRATEGIES

WHICH FACILITATE LEARNING FOR MASTER.

Introduction

The purpose of this paper is to discuss the "state of the craft" of instruction within the context of the mastery learning model. In order to place this paper into proper perspective, two major points must be made at the outset. First, proponents of mastery learning have rarely addressed the problem of designing instructional strategies. It is no accident that the title of Bloom's (1968) paper is "learning for mastery" rather than "teaching for mastery." The initial emphasis of the mastery learning model was on gathering information about student learning (and failing to learn) and doing whatever was necessary to help those who did not initially learn to learn eventually. Primarily this was achieved by developing a philosophy about school learning asserting that virtually all students are capable of attaining excellence in learning if there are appropriate learning conditions and a set of program specifications (e.g., pre-conditions, operating procedures) that would produce programs supportive of the philosophy.

When instructional strategies have been considered at all, they have been addressed in fairly global terms. This global approach to instruction was taken purposely so the the recommended procedures could be applied to a variety of settings and situations. As a consequence, however, little was said about specific instructional strategies that are applicable to particular instructional units or objectives, or to the daily classroom life of teachers.

Second, the development of mastery learning programs has paralleled the development of mastery learning theory. In other words, concerns for instruction have usually been voiced well into the development of mastery learning programs. A rather typical set of phases for the development of mastery learning programs is as follows. Phase I consists of a debate/discussion on the value of mastery learning and the philosophical issues underlying a movement toward a mastery learning program. Questions about instruction may be voiced during this phase but if they are, they tend to be rather vague and generalized (such as "what do we do with those students who fail to learn initially"). Phase II consists of the identification of goals and objectives, the parsing of objectives into courses and instructional units, and the sequencing of the objectives and/or units. Phase III consists of the construction of summative and formative tests. Phase IV consists of the provision of corrective instructional activities. Usually this phase occurs through gathering together a laundry list of activities (study groups, programmed materials, academic games, and the like) which are believed to be useful as correctives. Phase V is typically the phase dealing with the real concerns about instructional activities. This phase often begins with an examination of the relationship between the group-based instruction and the corrective or supplementary instruction. Depending on the school or district, the first four phases can take anywhere from one to ten years to complete. As a consequence, developers of mastery programs have a tendency to "run out of gas" just as the work on instruction is about to begin.[1]

This paper is organized into six major sections. The first section outlines the general instructional conditions and procedures described

in books and articles dealing with mastery learning. The second section discusses two aspects of the initial group-based instruction: teaching to objectives and the use of appropriate teaching methods or presentations. The third section focuses on the importance of proper sequencing of instructional activities and units. The fourth section presents information concerning corrective instruction. The fifth section briefly details the types of enrichment activities used in existing mastery learning programs. Finally, the sixth section presents ideas concerning the role of classroom management in complementing a mastery learning instructional program. Thus, while the early sections of this paper chronicle the instructional conditions and procedures documented by writers in the field of mastery learning, the later sections describe instructional strategies which are neither unique to the theory of mastery learning nor to the implementation of existing mastery learning programs. Instead, many of the instructional strategies described are those which research indicates are related to increased student involvement in learning and/or increased student achievement.

General Instructional Procedures for Mastery Learning

The first attempt to prescribe instructional procedures within the context of mastery learning was presented by Block (1971). In actuality, Block's recommendations stem from his perceived importance of orienting students to learning within a mastery approach to instruction. As such, these procedures can best be labeled "orientation procedures." Four years later, Block and Anderson (1975) presented and discussed a list of steps to be followed when implementing mastery learning programs in

classrooms. Then, one year later, Anderson and Block (1976) presented a slightly different list. A composite list, drawn from these related, but separate, lists, is displayed in Table 1.

INSERT TABLE 1 HERE

As can be seen in Table 1, the steps describe fairly general procedures which are applicable to mastery learning programs in general. The procedures begin with the presentation of the objectives for a single unit and end with the administration of the summative test (constructed to assess several units' worth of objectives).

From an instructional perspective, the keys to the success of mastery learning programs lie in step 4 (dealing with the presentation of the group-based instruction on a daily basis), step 7 (dealing with the provision of enrichment activities or opportunities), and steps 9 through 11 (dealing with the corrective portion of the instruction).[2] Each of these steps (or sets of steps) is discussed in greater detail in the next three sections.

Original Group-Based Instructional Strategies

Block and Anderson (1975) do, in fact, provide some fairly concrete suggestions concerning the provision of group-based instruction. These suggestions are indicated in parentheses following step 4 in Table 1. Block and Anderson suggest that the focus of instruction is on keeping students actively involved in learning, or "on-task." They indicate three ways in which this may be accomplished by the classroom teacher. First, the teacher can provide incentives for learning. These incentives

can take the form of material incentives (such as prizes, grades) social incentives (such as praise), and learner-preferred activity incentives (such as "free time"). Second, the teacher, in making the presentation of the learning material to the students, should attempt to highlight the relevancies and "play-down" the irrelevancies. The use of advance study questions for a reading assignment is one example of highlighting relevancies. The erasure of irrelevant material from a chalkboard is one example of "playing-down" irrelevancies. Third, the teacher should make use of appropriate classroom management techniques in order to hold down disruption and keep the vast majority of students on-task. More will be said about this suggestion in the last section of this paper. In addition to these three suggestions for maintaining student involvement in learning, Block and Anderson indicate the need for proper sequencing of instruction ("tie-in new learning with old") and the concern for remembering what is initially learned ("use periodic review"). While these suggestions are fairly explicit, they refer only to general instructional strategies and not to instructional strategies which are specific to various instructional objectives, different students, or daily classroom situations encountered by the teachers. In contrast, the remainder of this section will focus on specific instructional strategies within a group-based instruction context.

These specific instructional strategies focus on two "facts of life" in classrooms: various types of objectives are taught and various methods are used to teach the objectives. With respect to each of these "facts," one or more questions may be raised. Are there more effective ways of teaching different types of objectives? Are there students for whom alternative ways of teaching are likely to be more effective? These

questions address two related, yet different problems: teaching to objectives, and teaching/learning methods. The relationship between these two problems is fairly straightforward. The problem of teaching to objectives is one of identifying what should be presented to students if they are to acquire particular types of objectives. The problem of selecting appropriate teaching/learning methods is one of deciding how to present the material relevant to the objectives to the students. Perhaps the distinction between teaching to objectives and selecting appropriate teaching methods can be clarified through the use of an example. We may decide that teaching to particular types of objectives requires the presentation of a set of examples. The presentation of examples would relate to teaching to objectives. Now we must decide how the objectives should be presented. Should they be presented orally or visually, via discussion or via lecture? These forms of presentation would relate to the appropriate teaching/learning methods.

Teaching/Learning Methods

Teaching/learning methods typically are referred to simply as teaching methods. The term "teaching/learning methods" is preferred because it emphasizes that both teaching and learning activities are indicated either explicitly or implicitly by the choice of "teaching method." Consider, for example, two frequently used teaching methods: lecture and seatwork. At first blush, lecture seems to be a teaching method and seatwork seems to be what might be called a "learning method." Both, however, have implications for teaching and learning if the method is to be successful in terms of facilitating achievement. If, for example, students sit passively and daydream during a lecture,

little will be learned. Similarly, if a teacher sits behind the desk or leaves the room during a seatwork assignment, the effectiveness of the seatwork assignment is decreased.

Four teaching/learning methods are most frequently used in classrooms. In addition to the two mentioned above (lecture and seatwork), classroom discourse and discussion are popular in many classrooms. A brief description of each of these activities is presented in Table 2.

INSERT TABLE 2 HERE

It is quite likely that these teaching/learning methods are useful for different types of learners and for achieving different types of instructional objectives. Furthermore, it seems likely that the teacher's role in each of these activities is somewhat different. In 1976, an entire volume of the National Society for the Study of Education Yearbook was devoted to the psychology of teaching methods.[3] Based on the information presented in this volume and the results of research studies conducted in this area, the following table attempts to clarify what we know about the four teaching/learning methods mentioned earlier.

INSERT TABLE 3 HERE

As can be seen in Table 3, the activities seem to be appropriate for different types of learners. The relationships seem quite obvious when the demands of the particular activities are considered. The appropriateness of the activities for different instructional objectives is less well documented.

Teaching to Objectives

Teachers tend to be baffled when confronted with a directive to teach to objectives. Part of this "bafflement" stems from the fact that there seem to be so many objectives to teach. Several classification schemes have been proposed in order to make sense of the volumes of objectives. Perhaps the best known classification scheme is that proposed by Bloom and his colleagues (1956), the Taxonomy of Educational Objectives: Cognitive Domain. Other schemes have been proposed by Gagne (1970, 1972), Merrill (1971), and Tiemann and Markle (1975). After reviewing these schemes and a host of instructional objectives and test items used by schools and districts throughout the country, Anderson (1979) proposed a classification scheme based on the "content" of the objectives; a scheme which accounts for approximately 88 percent of elementary and secondary school objectives surveyed. Anderson proposed three types of objectives: informational, conceptual, and procedural. A brief description of each type of objective is given. These descriptions are followed by a discussion of appropriate teaching strategies and teaching methods for each type of objective.

Informational Objectives. Information can be defined as sentences or phrases which society (or its designate, such as curriculum guides, teachers, or school boards) believes to be important or interesting in their own right. Two levels of information can be identified: facts and generalizations. Briefly, facts are sentences or phrases which pertain to a particular person, object, event, or experience. Generalizations are sentences or phrases which pertain to a category of persons, objects, events, or experiences.

Informational objectives typically state that students will remember or understand the information presented. As such, informational objectives resemble Gagne's category of verbal information. At the same time, however, they also resemble Bloom's categories of knowledge and comprehension.

In most instances, educators are willing to accept that students have attained informational objectives if they can (1) recall verbatim the information, (2) answer who, what, where, when questions about the information, (3) state the information "in their own words" (that is, paraphrase the information), or (4) make correct inferences based on information presented. The first two behaviors would test the students' knowledge of the information; the last two would indicate the students' comprehension of the information.

Conceptual Objectives. Concepts can be defined as categories of objects, events, experiences, or ideas which give meaning to symbols (e.g., words, numerals, pictures). All members of the concept must share a thing or things in common. The thing(s) they share are termed the "critical attributes" or "defining features" of the concept.

Conceptual objectives typically state that students will understand the concepts. Occasionally, conceptual objectives state that students will understand the relationship among concepts. Thus, the content portion of conceptual objectives resemble Gagne's category of concepts or concept learning. The operations portion, on the other hand, resembles Bloom's comprehension (and analysis) categories.

Educators seem willing to accept that students have acquired a conceptual objective if they can (1) correctly identify new examples

and illustrations of the concept, (2) eliminate incorrect examples, and/or (3) correctly identify the distinguishing features between or among concepts.

Procedural Objectives. Procedures can be defined as sequences of mental or physical activities that can be used to solve problems, gather information, or achieve some desired goal. Two types of procedures are of interest in most school settings. Linear procedures are those in which the sequence of activities are performed in order. That is, regardless of what the outcome of the first activity is, the second activity is performed based on that outcome. Branching procedures are those in which one or more of the activities involve decision-making. That is, depending on the outcome of the first activity, the person may need to perform either the second or the third activity. Single step procedures are frequently termed rules.

Procedural objectives typically state that students will apply, or make use of, the procedures. Thus, procedures would be similar to Gagne's rule and problem-solving approaches. Procedures are similar to what Landa (1974) and Scandura (1975) refer to as algorithms. An , procedural objectives are typically written at the application level of Bloom's taxonomy.

Teachers are willing to accept the fact that students have attained procedural objectives if, given a problem situation, the student can (1) select the correct procedure to apply, and (2) apply the procedure correctly.

One final note concerning these three types of objectives is in order. Initial classification of an instructional objective into one

of the three typologies can be made by examining the content and operational portions of the objective itself. To the extent that teachers differ in their presentation or emphasis of the materials relative to an objective, however, reclassifications of objectives are in order. Consider, for example, an instructional objective dealing with Boyle's Law. One teacher might focus on the concept of law as used in science. In this instance, Boyle's Law becomes a conceptual objective. Another teacher might be content to have students remember the formula for Boyle's Law. In this case, Boyle's Law becomes an informational objective. (Although this latter teacher may, in fact, expect students to apply Boyle's Law to the solution of appropriate problems, a procedural objective, the actual teaching is appropriate for an informational objective). The teacher who truly hopes that students will be able to apply Boyle's Law to the solution of appropriate problems and works on teaching students how to apply it would be teaching Boyle's Law in the context of a procedural objective.

These three types of objectives are useful not only because they represent the realities of present curricula but also because researchers have concentrated their efforts within each of these categories. Particular researchers tend to be associated with research in the learning of these three types of objectives. William Rohwrer (1973), David Ausubel (1960), Ernst Rothkopf (1966), Joel Levin (1976), and Claire Weinstein (1979) have investgated issues related to the learning of informational objectives. John Carroll (1964), Herbert Klausmeier (1976), and Susan Markle (1975) have conducted critical research in the learning of conceptual objectives. Finally, Bonnie Meyer (1977), Ann Brown (1979), and Nancy Stein (1978) as well as Lev Landa and Joseph Scandura (mentioned earlier) clearly

lies within the area of procedural objectives. The results of research suggest that different presentations are important for the learning of different types of objectives. The following subsections describe some of the presentations that are important if learning is to occur. The presentations included tend to be agreed upon by the majority of the educational psychologists, supported by a certain amount of research evidence, and "do-able" within the context of typical classroom settings.

Teaching Informational Objectives. The acquisition of informational objectives tends to be facilitated if (1) the information to be learned is indicated to the learner (that is, the learner is made aware of the information that is important to learn), (2) the learner is forced to process the underlying structure of the information in-depth by paraphrasing, summarizing, and outlining the key ideas and their relations, (3) memory strategies (such as categorizing, elaborating, and visualizing) are suggested for the information that is important to learn), (4) memory strategies (such as mnemonic devices, imagery, and mental elaboration) are suggested to the learner, (5) advance organizers and/or overviews are used to introduce the information to be learned and to build a bridge between the information to be learned and previously learned information, concepts, and procedures, and (6) drill and repetition are used after the information has initially been presented. Finally, if the informational objective is in the form of a generalization, illustrations or explanation of the generalization should be presented. This has the effect of "concretizing" the generalization; that is, making the abstract, concrete. An application of these presentations to the teaching of a particular informational objective is displayed in Table 4.

INSERT TABLE 4 HERE 14

As will be noted, the term "presentation" or its equivalent is used throughout Table 4. Consideration as to the types of presentations that can be used will be discussed later in this paper.

Finally, the five presentations indicated in Table 4 are those most applicable to the widest range of age levels and subject matters. Other presentations, such as those specific to reading material (cf., Jones, 1980), are both available and desirable. The attempt here, however, is to focus on presentations that are the "minimal acceptable" presentations for the teaching of this type of objective.

Teaching Conceptual Objectives. The acquisition of conceptual objectives tends to be facilitated if (1) critical attributes or defining features of the concept are presented, (2) similarities and differences of the new concept with respect to previously learned, related concepts are presented, (3) examples or instances of the concept are presented, and (4) non-example or non-instances of the concept are presented. Once the concept has been acquired, the attachment of the correct label to the concept is facilitated if presentations similar to those used in teaching informational objectives are used.

An application of these presentations to the teaching of a particular conceptual objective is displayed in Table 5.

INSERT TABLE 5 HERE

Teaching Procedural Objectives. The acquisition of procedural objectives tends to be facilitated if (1) the nature of the procedure and the steps that comprise the procedure are presented, (2) the application of the procedure to typical problem situations is presented

in a "step-by-step" fashion, (3) the limits of applicability of the procedure (that is, the situations to which the procedure does and does not apply) are presented, and (4) supervised, distributed practice of the application of the procedure is provided and encouraged. The term "supervised" refers to practice that is monitored by the teacher, a peer, or an answer key so that errors are not allowed to accumulate. The term "distributed" refers to practice that occurs over an extended period of time (say, several weeks or months). The term "distributed practice" is often used in contrast to "massed practice" which is similar to drill and repetition in that it is intensive practice over a fairly short period of time. Finally, distributed practice is generally thought to facilitate comprehension and retention better than massed practice, expecially if the information is complex.

An application of the teaching of a particular procedural objective is displayed in Table 6.

INSERT TABLE 6 HERE

Group-based instruction would likely be quite effective if the guidelines given in Tables 4 through 6 were followed. Thus, tables similar to these tables would contain reasonable expectations for teaching for each instructional objective included in a mastery learning program.

Sequencing or Ordering of Instruction

Two types of sequencing or ordering are important: (1) sequencing within instructional units, and (2) sequencing across instructional units. The first type of sequencing is concerned with the order in which the objectives (i.e., information, concepts, and procedures) in each unit should be taught. The second type of sequencing is concerned with the order in which units should be taught.

Several general principles of sequencing have been expounded. One such principle states that objectives or units which are prerequisite to other objectives or units should be taught first. A sound principle, based on Gagne's (1970) work, indicates that concepts should be taught prior to principles or rules which, in turn, should be taught prior to problem solving. In most instances, however, these principles remain abstract and are either not translated into practice or, if they are translated into practice, then the translation occurs via the "looks-as-if" approach. For example, the objective certainly "looks-as-if" it is prerequisite to this other objective.

Recently, however, Stoll (1980) and Jones (1980) have suggested a set of five fairly specific dimensions that can aid in the actual sequencing of objectives within units and units themselves. These dimensions can be termed (1) teacher direction, (2) amount of reading, (3) support, (4) content, and (5) time. The "teacher direction" dimension begins with highly teacher-directed activities involving much interaction with the students by eliciting paraphrases, summaries, inferences, and applications from them. As the units or objectives proceed, the teacher encourages the students to perform these activities

on their own. Thus, as objectives and units progress from first to last, amounts of teacher direction should decrease.

One of the vehicles needed to make this move from teacher-directed to independent, learner-directed, is skill in reading. Thus, the reading dimension begins in the early objectives/units with no reading and progresses through the reading of words, then phrases/sentences, then paragraphs, and finally the reading of longer selections of increasing difficulty. The purpose of this approach is to initially focus on the objective rather than on the complex material in which the objective is embedded. As the student becomes more skilled in identifying the objective, the amount of material to be read and comprehended is gradually increased.

The third dimension, support, also is related to the teacher-direction dimension. This dimension begins with alternative responses being provided to the students and moves to the students producing their own alternatives. This dimension is similar to a progression from select-type test items (e.g., multiple-choice tests) to supply-type test items (e.g., short-answer completion tests). It also is important to note that initially only a few alternative responses (perhaps only two) are provided. In addition, students are given hints as to the correct response. In this way, student success is built into the program early.

One way of looking at the first three dimensions is to consider them as elements of responsibility for learning. In any sequence of objectives or units the teacher initially has primary responsibility for learning. At some mid-point in the sequence, the responsibility for learning becomes shared by the teacher and the students. Finally, toward the end

of the sequence, the students assume the primary responsibility for learning.

The fourth dimension is "content." Sequencing along this dimension involves the movement from content which is simple, concrete, explicit, and familiar to content which is complex, abstract, implicit, and novel. This dimension closely parallels the reading dimension since reading enables one to comprehend more complex, abstract, and unfamiliar content.

The final dimension, time, is related to the belief that schools are to produce efficient as well as effective learners. Initially, the emphasis should be on producing effective learners, regardless of the time involved. Thus the time dimension begins with the absence of time constraints. Eventually, however, the learners should be able to learn in a reasonable amount of time; that is, they should become more efficient in their learning.

These five dimensions seem to highlight the concerns that must be addressed when considering the question of sequencing. Their concreteness provides some direction for the actual sequencing of objectives, units, and even courses beyond that which has been available.

Corrective Instruction

Research on mastery learning (Block and Burns, 1976) has suggested that feedback and "correctives" are the key components of mastery learning programs. As has been indicated earlier, most mastery learning programs begin with a "laundry list" of instructional activities and materials which can be used as "correctives." Although this is a useful beginning, additional steps must be taken if sound "correctives" are to be made available to students.

Block and Anderson (1975) suggest that potential corrective instructional activities be classified according to two dimensions: individual-group and presentational-involvement. The individual-group dimension refers to whether a corrective is appropriate for individual students, small groups of students, or both. This distinction is important because of the "dual phase" of most corrective instruction. As can be seen in Table 1 (step 8), the items missed by non-masters can be divided into those missed by many non-masters and those missed by a few of the non-masters. The first phase of corrective instruction focuses on the objectives underlying the items missed by many non-masters. As a consequence, group correctives tend to be used. The second phase of corrective instruction focuses on the objectives underlying the items missed by a few of the non-masters. Hence individual correctives are useful in this phase.

The presentational-involvement dimension is an interesting one. Simply put, the distinction is concerned with whether the learning problem has resulted from the failure to get the material "inside of the student" (presentational), or from the failure to get the student to "do something with the material once inside" (involvement). In this regard, Block and Anderson (1975) write "we have tended to find that the involvement correctives... seem to be more popular with and effective among students than the presentational correctives. We believe that this is because most group-based plans of instruction tend to focus primarily on presenting the materials and ignore involving students in its learning..." (p. 38).

A summary of typical correctives classified according to the two dimensions is presented in Table 7.

INSERT TABLE 7 HERE

We have found it useful in selecting appropriate correctives to consider corrective instruction as supplementary to the original instruction. Thus, in selecting appropriate correctives, the relationship of the correctives to the original instruction must be kept in mind. One way of doing this is to conduct a brief analysis of the original instruction in terms of (1) the specific presentations that will be made in the teaching of a particular objective, and (2) the teaching/learning methods within which the specific presentations will be embedded.

Suppose, for example, you are designing corrective instruction for a particular conceptual objective. Further, suppose your original instruction consisted of classroom discourse in which examples and non-examples were shown to students, students are asked to determine what all the examples have in common, and the list of common characteristics were written on the chalkboard. The analysis of the original instruction would be as follows:

METHOD - classroom discourse
PRESENTATIONS - examples, non-examples, critical attributes
MODE OF PRESENTATIONS - pictoral, verbal questions, chalkboard
ORDER OF PRESENTATIONS - inductive

Useful correctives would differ in one or more of the four attributes indicated above. Thus, a potential corrective could include any or all of the following:

METHOD - discussion
PRESENTATIONS - relationships with relevant concepts,
critical attributes
MODE OF PRESENTATIONS - oral interchange, overhead projector
ORDER OF PRESENTATIONS - deductive

The basic rule for "correctives" remains the same as stated by Block and Anderson (1975). "They must teach the same material as does your (original instruction plan), but they must do so in ways that differ from this plan" (p. 33). In terms of presentation and involvement this rule means "your correctives should present the unit's materials in ways that differ from the way your (original instruction) will present it. They should also involve students in learning the unit's material in ways that differ from the way your (original instruction) will involve them" (p. 33).

Enrichment Activities

Perhaps no issue is raised more frequently by educators contemplating adopting a mastery learning approach than the one concerning enrichment activities. Most frequently the question is phrased as follows: what do you do with students who pass the formative test after original instruction while the other students engage in correctives? This question is raised largely because of the group-based approach to instruction suggested by mastery learning advocates. Note: If a student-based or self-paced approach is used, the answer is self-explanatory; they proceed to the next instructional unit.

Several options exist for the solution of this problem. The options tend to develop over the duration of a mastery learning program. That is, programs tend to begin with what can be called Option 1 and progress, if desired, to Option 4. Let us consider each of these options in turn.

Option 1 - Engage in Tutoring. The most easily implemented option is to use the initial "masters" as tutors. If this is to be done, however,

(1) the students must be willing to serve as tutors, (2) have specific tutorial materials available, and (3) be trained in tutoring. Note: The interested reader is encouraged to read an article by Doug Ellson (1976) or a monograph by Sophie Bloom (1976).

Option 2 - Engage in Work in Other Subject Areas or "Free" Work. Another quite readily available option is to permit students to complete "left over" work in other subject areas. Students also may be free to work in areas of their own interests or to engage in "recreational reading."

Option 3 - Engage in Independent Learning. This option usually takes the form of "contract" learning. Students are required to complete an "independent learning" form. On this form they must specify (1) what is to be learned, (2) how it is to be learned, and (3) how they are to demonstrate what they have learned. An estimated time needed should also be assessed.

Option 4 - Engage in "Vertical Enrichment." In one sense self-pacing may be seen as allowing for "horizontal enrichment." Students progress from unit to unit learning more and more concepts, information, and procedures. In contrast to "horizontal enrichment," "vertical enrichment" allows one to probe deeper into the material contained in an instructional unit by examining relationships among the objectives in the unit or between the objectives in the present unit and past units.

Consider, for example, a science unit which contains two conceptual objectives. The first objective deals with students' ability to classify turtles correctly; the other deals with the students' ability to classify lizards correctly. Opportunities for vertical enrichment would center around questions, such as:

1. Draw a picture of a tizard (an animal that is part turtle and part lizard.

2. Write a story (compose a song) about a turtle and a lizard. Make sure that the setting of the story (song) is based on what you know about appropriate environments for turtles and lizards.

3. Find as many interesting facts/oddities about turtles/lizards as possible. Write them in a form appropriate for a "book of lists."

4. Suppose a lizard lost its tail (or a turtle lost its shell). Describe what adaptations the lizard (turtle) would have to make in order to survive.

As should be clear to the reader, vertical enrichment activities are limitless. The only boundary is the imagination of the teacher or staff member. Once a good set of such activities has been developed, they can be typed on file cards or on typing paper and laminated.

Classroom Management

One of the implicit assumptions underlying mastery learning is that if teachers are more effective managing learning, they will not need to spend as much time managing learners. That is, if the instruction is of high quality, classroom management problems become minimal. A recent study by Goldstein and Weber (1979) suggests that this assumption may not be warranted.

The study was conducted in classrooms of 35 elementary teachers. Observations of the classroom occurred for two full morning sessions. The findings can be briefly summarized in Table 8.

INSERT TABLE 8 HERE

Two findings are of interest. First, the instructional approach to classroom management is not related to student time-on-task. Thus, it may not be true that sound instruction is associated with a reduction in classroom management problems. It is important to note, however, that mastery learning techniques were not necessarily a part of what Goldstein and Weber called the instructional approach to classroom management. Thus, the findings do not necessarily negate the assumption mentioned at the beginning of this section.

Second, the two approaches to classroom management with the highest relationship with student time-on-task are extremely compatible with the mastery learning approach to instruction. Consider the essential features of what are called the "Group Process" and the "Socioemotional Climate" approaches. These essential features are displayed in Table 9.

INSERT TABLE 9 HERE

Given that there is some question about the validity of the assumption of the relationship between mastery learning and classroom management, and given that the most effective classroom management approaches are highly compatible with the mastery approach to instruction, it seems wise to suggest that both an instructional and classroom management approach be planned. The instructional approach, based on the ideas and prescriptions of mastery learning, would focus on improving learning through the control of appropriate <u>covert</u> behavior. The classroom management approach, based on some combination of the group process and classroom climate approaches, would focus on increasing or maintaining a level of <u>overt</u> behavior that is conducive to learning.

Conclusion

This paper has attempted to emphasize the role of instruction within mastery learning approaches to schooling. As a consequence, it has attempted to indicate instructional strategies, techniques, and methods not typically associated with the rather general instructional procedures recommended by proponents of mastery learning. To the extent that this attempt has succeeded, we can begin to see the communalities among various approaches and to move toward the design of effective instructional practices regardless of the labels used to describe them.

Although each set of the guidelines discussed in this paper is based on various strands of research, the paper as a whole is intended to be a concept paper directed both to those who theorize about the nature of learning and instruction, as well as those teachers,curriculum developers, and educators of teachers and curriculum developers who must put theory into practice. As a concept paper, it does not strive to be definitive nor does it aim to provide a comprehensive checklist of items to consider in developing instructional strategies and curriculum materials. Rather, it is intended to be suggestive and provocative.

Footnotes

[1]It's interesting to note that this typical development is contrary to the views of at least three mastery learning proponents: Bloom, Block, and Anderson. These educators emphasize the importance of (1) starting small (perhaps with two or three instructional units), (2) using existing goals, objectives, and summative tests, and (3) getting teachers involved in the practice of mastery teaching as soon as possible.

[2]From a general implementation perspective, several flaws emerge from "less than successful" mastery programs. While a discussion of these flaws is beyond the scope of this paper, a listing might help readers who are beginning serious consideration of mastery learning programs.

FLAW 1 - Failure to establish priorities among instructional objectives. In many programs all objectives are seen as equally important. Given the realities of subject matter (and classroom instruction), some instructional objectives are (and must be seen as) more important than others. Setting priorities among objectives has implications for the time allotments for instructional units, the setting of performance standards, and the evaluation/grading of students.

FLAW 2 - Failure to organize objectives into instructional units and to order/sequence the units based on rational or empirical considerations. "Less than successful" mastery programs often progress objective-by-objective without regard to sequencing, thereby destroying the structure of the subject matter and the structure of student learning.

FLAW 3 - Failure to properly orient students to the mastery learning program; failure to specify in advance the duration of the instructional units, the tentative date of the formative tests, and the amount of time

to be devoted to corrective instruction/learning (both in-class and out-of-class). Given that one purpose of mastery learning programs is to make explicit goals, objectives, tests, performance standards, and the like, it is surprising that the ways in which the goals/objectives will be attained remains implicit in many programs.

FLAW 4 - Failure to make rational, justifiable decisions about performance standards. Rather "quick and dirty" figures of 80 percent are used. Performance standards should be set based on answers to the question "What evidence will I (we) accept that learning has occurred?" As a consequence, performance standards should be set after careful examination of the objectives and the appropriate items on the formative and summative tests and may differ from objective to objective based on the complexity of the objective (from a psychological perspective) and the difficulty of the test items (from a psychometric point of view).

FLAW 5 - Tendency to over-test. Formal testing (such as paper and pencil formative tests) should occur only after the completion of an instruction unit (e.g., every 5-12 days). This is recommended for at least two reasons. First, the focus in mastery learning programs should be on instruction rather than testing. Yet some programs spend as much time on testing as they do on teaching. Second, learning takes time. Few, if any, objectives can be attained in 50 minutes. Third, testing students too often may create unnecessary feelings of being tested ad nauseum and testing may come to be seen as an end in itself.

Note that the above comments refer only to formal testing. Informal testing (such as teacher questions and short worksheets on a particular objective) should be integrated into the instructional process as is now being done by highly skilled teachers.

[3]See N.L. Gage (ed.) The Psychology of Teaching Methods. Seventy-Fourth Yearbook, Part I, National Society for the Study of Education. Chicago: University of Chicago Press, 1976.

[4]See A.A. Bellack, et al. The Language of the Classroom. New York: Teacher College Press, 1966. Also see C.J. Wright and G. Nuthall. Relationships between teacher behaviors and pupil achievement in three experimental elementary science lessons. American Educational Research Journal, 1970, 7, 477-91. The SOLICIT, RESPOND, REACT sequence describes the heart of the classroom discourse approach. The teacher begins with a question (SOLICIT). One or more students respond (either voluntarily or by being "called on"). The teacher reacts to the answer given by the student. The reaction can take the form of (1) feedback (e.g., that's right), (2) correction (e.g., no, remember that ....), (3) redirection of questions to other students (e.g., Billy, do you agree with Phyllis?), or some combination of forms.

Another effective REACT procedure for a student who does not know the correct answer is to ask one or more simpler questions that the student will be likely to be able to answer; then relate this answer to the original question. Suppose, for instance, that Howard does not know the meaning of the word exuberant. The teacher can ask Howard to use obvious context clues to infer the meaning. Alternatively, the teacher (1) can ask Howard if he knows the meaning of an obvious synonym (e.g., joy); (2) ask Howard to show how the synonym makes sense in the given context, and (3) ask Howard to reread the sentence or phrase using the new word exuberant.

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Table 1

INSTRUCTIONAL ACTIVITIES WITHIN A MASTERY PROGRAM

Orientation Activities (Block, 1971)

1. Students will be graded on the basis of final (summative) examination performance.
2. Students will be graded on the basis of their performance vis a vis a predetermined standard and not relative to their peers.
3. All students who attain the standard will receive appropriate grade rewards (usually A's) and there will be no fixed number of rewards.
4. Throughout the learning, students will be given a series of ungraded, diagnostic-progress tests to promote and pace their learning.
5. Each student will be given all the help he or she needs to learn.

Instructional Procedures (adapted from Block & Anderson, 1975, and Anderson & Block, 1976)

1. Present the objectives of the instructional unit. This can be done in the form of (a) unit tables of specifications, (b) study questions and/or (c) overviews/advance organizers.
2. Present the group-based instructional plan. Tell students how the material will be presented; give them some idea of the study strategies they might use to complement the proposed teaching method.
3. Announce the date of the diagnostic-progress test and the mastery performance standard on the test.
4. Present the group-based instruction on a day-to-day basis. (Focus on keeping students actively involved in learning or "on-task"; provide incentives for learning; highlight relevancies, play down irrelevancies; use appropriate classroom management techniques. Use periodic review; "tie-in" new learning with old.)
5. Administer the unit diagnostic-progress test at the designated time.
6. Identify satisfactory/unsatisfactory progress in learning with respect to the unit's objectives; inform students.
7. Certify satisfactory progress in learning publicly. Those students who are so certified can (1) tutor, (2) engage in enrichment activities, and/or (3) engage in independent learning or study.
8. Meet with nonmasters on the unit. Identify items on diagnostic-progress test that many of the nonmasters answered incorrectly. Identify items on diagnostic-progress test that few of the nonmasters answered incorrectly.
9. Begin with objectives missed by many of the nonmasters; use group correctives.
10. For the remainder of the objectives, give students the list of correctives; explain purpose of list and how to use it. Indicate when group-based instruction on the next unit will begin.
11. Monitor the corrective phase of instruction.
12. Administer the review diagnostic-progress test. Tell students to do only those items which correspond to the incorrect items on the diagnostic-progress test.
13. Certify those students whose performance is now satisfactory.
14. After all the learning units in a particular "marking period" have been completed, administer the summative test.

Table 2

DESCRIPTIONS OF FOUR BASIC TEACHING/LEARNING METHODS

Activity	Description
Lecture	Lecture refers to the presentation of instructional material in a continuous fashion by a single emitter. In its strictest sense, the presentation is primarily verbal in nature and is made by the teacher. In its broadest sense, however, lecture can include the use of instructional films, video-cassettes or audio tapes, and diagrams or charts, since the material is, in fact, continuous and presented by a single emitter. Teacher demonstrations also can be classified as lecture-type activities.
Seatwork	Seatwork is characterized by individual students working on an assigned task at their desks, tables, or "learning station." The task may be a writing or reading assignment, a problem to be solved, or a series of exercises to be performed. Students also could be working with a computer or "hooked-into" an audio-cassette tape.
Classroom Discourse	Classroom discourse refers to a series of teacher question-student response situations in which the teacher, in addition to asking questions, uses the students' answers as a springboard for mini-lectures on the material. What is commonly called recitation tends to be classroom discourse without the mini-lecture.
Discussion	The discussion approach is characterized by students' verbal exchange of ideas, concerns, and the like. The teacher can interrupt the dialogue either to allow another student to participate or to refocus the direction of the group. Discussion can take place either in large groups or small groups.

Table 3

TEACHING/LEARNING METHODS RELATED TO LEARNING SITUATION

Activity	For Whom	Teacher Responsibilities
Lecture	Moderate to high verbal students; students with good study skills	1. Expound responsibilities. 2. Structure presentation. 3. Place material in appropriate context.
Seatwork	Students with positive self-concept of ability; ability to work independently; students with good reading skills	1. Circulate around room. 2. Monitor work.
Classroom Discourse	Students in heterogeneously-grouped classrooms	1. Use SOLICIT, RESPOND, REACT sequence[4] 2. Summarize periodically.
Discussion	Students with weak reading skills and/or weak independent study skills	1. Create heterogeneous discussion groups of approximately five students 2. Faster moderate rather than high cohesiveness (i.e., some differences of opinion are important). 3. Establish seating arrangements conducive to communication. 4. Exercise democratic rather than authoritarian leadership style.

Table 4

TEACHING INFORMATIONAL OBJECTIVES

General Steps	Illustration
1. Present the fact or generalization.	1. A very important theorem in mathematics is called the Pythagorean Theorem. The Pythagorean Theorem says that the square on the hypotenuse is equal to the sum of the squares of the other two sides.
2. Present advance organizers, overviews.	2. Recall finding the perimeters of triangles. Suggest a situation in which it might not be possible to calculate the perimeter because the hypotenuse cannot be measured directly. Ask "what would you do?"
3. Present memory strategies that aid student in retaining fact/generalization; e.g., stories and visual aids (especially diagrams of relationships and text outlines) as well as instructions to involve student in information processing (paraphrase, visualize, infer, summarize, apply, etc.).	3. Perhaps a pun on the theorem would do. Tell story of three pregnant Indian women who lived in tepees with different animal skins as floors. Punch line: The squaw on the hippopotamus is equal to the sons of the squaws of the other two hides. (Admittedly a bad pun, but very effective.)
4. Provide opportunities for drill and/or recitation.	4. (a) Have students look at various triangles with lengths of sides given. Ask: "Which triangles illustrate the Pythagorean Theorem?" (b) Have students practice telling each other the "pun" story ending with a correct statement of the Pythagorean Theorem.
5. If informational objective is a generalization, present example or illustration of the generalization.	5. Draw a right triangle 3 in. x 4 in. x 5 in. Demonstrate that $5^2 = 3^2 + 4^2$ Draw several other right triangles; demonstrate that theorem holds.

Table 5

TEACHING CONCEPTUAL OBJECTIVES

General Steps	Illustration
1. Present the critical attributes of the concept.	1. A mineral is something that has four important features. (a) A mineral is found in nature. (b) A mineral is made up of a substance that was never alive. (c) A mineral has the same chemical makeup wherever it is found. (d) The atoms of a mineral are arranged in a regular pattern, and form solid units called crystals.
2. Present relationships with familiar, related concepts.	2. A few days ago, we learned about rocks and gems. Today, we're going to learn about things that are something like rocks and gems but are somewhat different. (Discuss similarities and differences among rocks, gems, and minerals.)
3. Present examples and show <u>how</u> examples illustrate the critical features. This may be done by teacher explanation or by eliciting responses from students.	3. Diamonds, gold, copper, iodine
4. Present non-examples and explain why they are non-examples.	4. Man-made diamonds (violate feature a). Coal, petroleum (violate feature b). Sand (violates feature c). Calcium found in milk (violates feature d).

Table 6a

TEACHING PROCEDURAL OBJECTIVES

General Steps	Illustration
1. Define the key concept(s) and present the steps that make up the procedure.	1. Explain what a main idea is. Explain that finding one is a process. This is best done in the form of a flow chart. See the attached sheet for an example of the procedure for finding the main idea of a paragraph.
2, Present applications of the procedure to use on three problems or situations indicating "answers" that follow from the successful application of each step.	2, Begin with a paragraph whose main idea is stated in the first sentence. Move to paragraphs whose main idea is stated in a sentence other than the first. With these paragraphs, go through each step of the procedure showing that the main idea is not in the first sentence. Finally, end with paragraphs whose main idea must be inferred from the entire set of sentences. Again, go through the entire procedure, showing that the main idea is not stated in any of the sentences in the paragraph.
3. Present a set of problems or situations to which the procedure does apply and does not apply.	3. Identify several paragraphs which possess three characteristics: (a) age-appropriate vocabulary, (b) age-appropriate sentence structure, (c) age-appropriate paragraph length. Some of the paragraphs should have the main idea explicit in the first sentence, some should have the main idea explicit in the last paragraph, and some should have an implicit main idea. Some of the paragraphs should be written without a main idea.
4. Present opportunities for supervised practice of procedures. Use diagrams, other visual aids, or checklists to illustrate the key concepts and steps in a procedural objective.	4. Present worksheet on which two or three paragraphs are presented. Make sure directions clearly indicate what students are to do. Have students work on each paragraph under supervision: (1) Work on paragraph, then put on board; (2) Work in small group; and (3) Work and check with answers on board.

Table 6b

A Procedure for Finding a Main Idea

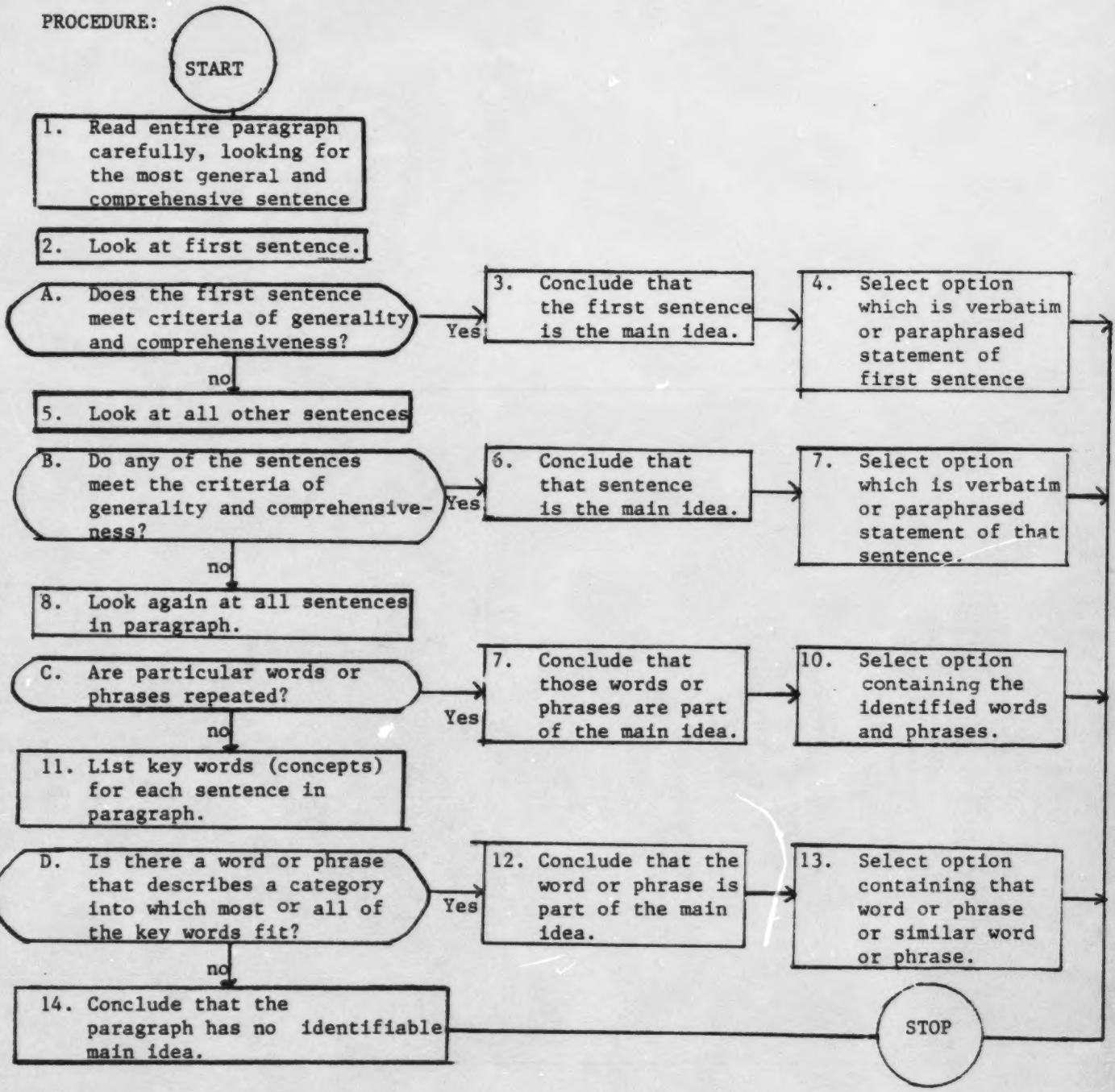
PROCEDURE:
START
1. Read entire paragraph carefully, looking for the most general and comprehensive sentence
2. Look at first sentence.
A. Does the first sentence meet criteria of generality and comprehensiveness?
Yes
3. Conclude that the first sentence is the main idea.
4. Select option which is verbatim or paraphrased statement of first sentence
no
5. Look at all other sentences
B. Do any of the sentences meet the criteria of generality and comprehensiveness?
Yes
6. Conclude that that sentence is the main idea.
7. Select option which is verbatim or paraphrased statement of that sentence.
no
8. Look again at all sentences in paragraph.
C. Are particular words or phrases repeated?
Yes
7. Conclude that those words or phrases are part of the main idea.
10. Select option containing the identified words and phrases.
no
11. List key words (concepts) for each sentence in paragraph.
D. Is there a word or phrase that describes a category into which most or all of the key words fit?
Yes
12. Conclude that the word or phrase is part of the main idea.
13. Select option containing that word or phrase or similar word or phrase.
no
14. Conclude that the paragraph has no identifiable main idea.
STOP

Table 7

SUMMARY OF CORRECTIVES CLASSIFIED BY INDIVIDUAL-GROUP AND PRESENTATION-INVOLVEMENT DIMENSIONS

Corrective	Individual	Group	Presentation	Involvement
Alternative Textbooks	x		x	
Workbooks	x		x	
Flashcards	x		x	
Reteaching		x	x	
Audiovisual Materials*		x	x	
Token Economies	x			x
Academic Games		x		x
Group Affective Exercises*		x		x
Programmed Instruction	x		x	x
Tutoring	x		x	x
Small Group Study Sessions		x	x	x

*These correctives might also be used on an individual basis in some situations. (From Block and Anderson, 1975).

Table 8

RESULTS OF GOLDSTEIN AND WEBER STUDY

Classroom Management Approach	Correlation with Student Time-On-Task
Group Process	0.51*
Socioemotional Climate	0.32*
Behavior Modification	0.15
Instructional	0.15
Common Sense	0.03
Authoritarian	-0.48*
Permissive	-0.53*

*The asterisks indicate correlations that are statistically significant ($p < .05$).

Table 9

CRITICAL FEATURES OF THE GROUP PROCESS
AND SOCIOEMOTIONAL CLIMATE
APPROACHES TO CLASSROOM MANAGEMENT

(Source: Goldstein and Weber, 1979)

Approach	Critical Features
Group Process	1. clear expectations concerning behavior 2. shared leadership 3. high attraction 4. productive group norms 5. open communication 6. high cohesiveness 7. appropriate teacher behaviors, such as "withitness" behaviors, "overlappingness" behaviors, movement management behaviors, and group focus behaviors
Socioemotional Climate	1. effective communication 2. teachers talking about situations rather than character or personality of students 3. personal involvement of teachers with students 4. students taught to make intelligent decisions 5. use of logical consequence rather than arbitrary punishment in dealing with student misbehavior